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A
Brief Deſcription
OF THE
SOLAR SYSTEM.

To which is Subjoined,

An *Aſtronomical* ACCOUNT
Of the YEAR of
OUR SAVIOUR'S
CRUCIFIXION.

By *JAMES FERGUSON.* R

The Works of the LORD *are great, ſought out of all them that have Pleaſure therein.* Pſ. cxi. 2.

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A
BRIEF DESCRIPTION
OF THE
SOLAR SYSTEM.

THE SUN! that immenſe and amazing Globe of Fire, whoſe Circumference is 2,398,000 Miles, is placed in the Centre of our Syſtem, and turns round like a Wheel on its Axis in 25 Days and 6 Hours. This glorious Luminary has ſix opaque Globes or Planets belonging to it, called Mercury, Venus, the Earth, Mars, Jupiter, and Saturn.

MERCURY, the neareſt Planet to the Sun,

goes round him in 87 Days 23 Hours; travelling at the rate of 100,000 Miles every Hour. Its Diſtance from the Sun is 32,000,000 of Miles, and its Circumference 13,350. Its Light and Heat is ſeven times as great as ours.

VENUS, the next Planet in order, is 59,000,000 of Miles diſtant from the Sun, and goes round him in 225 Days 17 Hours; moving at the rate of 70,000 Miles every Hour; her Circumference is 24,823 Miles, and ſhe turns round her Axis in 24 Days 8 Hours, according to *Bianchini*. Her Light and Heat is almoſt twice as great as ours.

THE EARTH, betwixt the Orbits of Venus and Mars, is 81,000,000 of Miles diſtant from the Sun, and goes round him in a Year; moving 58,058 Miles every Hour, which is 120 times ſwifter than the Motion of a Cannon Bullet. Its Circumference is 25,020 Miles, and it turns round its Axis in 24 Hours. The Moon's Circumference is 6836 Miles, her Diſtance from the Earth 240,000; and the time of her going round the Earth from Change to Change is 29 Days, 12 Hours, 44 Minutes, 3 Seconds; in which time ſhe has juſt one Day and one Night.

MARS is the next Planet to the Earth; it goes round the Sun in 1 Year 322 Days 17 Hours, at the rate of 45,000 Miles every Hour. Its Diſtance from the Sun is 123,000,000 of Miles; its Circumference 13,967; it turns round its Axis in 24 Hours 40 Minutes. Its Light and Heat is not quite half ſo great as ours.

JUPITER, the biggeſt of all the Planets, is ſtill higher in the Syſtem; being 424,000,000 of Miles from the Sun: It performs its annual Courſe round the Sun in 11 Years 313 Days 15 Hours, advancing forward 24,000 Miles every Hour: Its Circumference is 254,469 Miles; it turns round its Axis in 9 Hours 56 Minutes. Its Light and Heat is but $\frac{1}{28}$ Part of ours, but this ſmall Quantity is compenſated in a great Meaſure by its quick Returns; and by four friendly Moons which in various times revolve round this huge Planet, there is ſcarce ever any Part of it but what is enlightened by one or more of them. The firſt, or neareſt Moon to Jupiter revolves round him in 1 Day 18 h. 28 m. the ſecond in 3 Days 13 h. 15 m. the third in 7 Days 3 h. 59 m. and the fourth in 16 Days 18 h. 30 m. This Planet ſeen from its neareſt Moon would appear 1387 times as large as our Moon does to us.

SATURN, the remoteſt of all the Planets from the Sun, is diſtant from him 777,000,000 of Miles; and by travelling 18,000 Miles in his Orbit every Hour, goes round the Sun in 29 Years 167 Days 10 Hours. His Circumference is 191,637 Miles, and he is ſurrounded by a vaſt, but thin Ring encompaſſing his Body as an Horizon does a Globe, no where touching it. The Light and Heat communicated to this Planet by the Sun, is but $\frac{1}{90}$ Part ſo great as to our Earth; but he has five Moons going round him for the ſame Purpoſe that Jupiter has four. The time of his Rotation on his Axis, as well as that of Mercury's, is unknown.

THE Circumferences and Diſtances of the Planets are expreſſed in Engliſh Miles: And if a Body was projected from the Sun ſo as to fly with the Swiftneſs of a Cannon Ball, *i. e.* 480 Miles every Hour, it would reach the Orbit of Mercury in 7 Years 221 Days; of Venus in 14 Years 8 Days; of the Earth in 19 Years 91 Days 12 Hours; of Mars in 29 Years 80 Days 16 Hours; of Jupiter in 100 Years 280 Days 13 Hours; of Saturn in 184 Years 240 Days 6 Hours; and to the neareſt fixt Stars not in leſs than 700,000 Years.

THE Planets are retain'd in their Orbits by the duly ballancing of their projectile Forces to that of the Sun's Attraction upon them: For, if the projectile Force of each Planet ſhould be ſtopt, and the Sun's Attraction upon it continue, Mercury would fall to the Sun in 15 Days 18 Hours; Venus in 39 Days 17 Hours; the Earth in 64 Days 10 Hours; Mars in 121 Days; Jupiter in 390 Days, and Saturn in 767. If the Moon's projectile Force was ſtopt, ſhe would fall to the Earth in 4 Days and 21 Hours.

LIGHT is known to come from the Sun to the Earth in 7 Minutes and an half; conſequently it flies at the rate of 648,000,000 of Miles every Hour; 10,800,000 Miles every Minute; and 180,000 Miles every Second of Time.

It is ſuppoſed there are 21 Comets belonging to our Syſtem, of which, only the Periods of three are known. The firſt of them appeared in 1531, 1607, and 1682; and is expected to appear again in 1758, and every 75 Years afterwards. The ſecond of them in 1532 and 1661; and ſo may be expected to return in 1789, and every 129 Years afterwards. The third, having laſt appeared in 1680, and its Period being no leſs than 575 Years, cannot return until A. D. 2255. To this Comet, the Sun when neareſt, appeared 57,600 times as large as the Sun does to us.

To give a natural and pleaſing Idea of the proportional Bulks and Diſtances of the Sun and Planets, I ſhall take the Liberty to quote the following Paragraph from *Wright*'s Synopſis of the Univerſe.

“The Diameter of the Dome of St. *Paul*'s is 145 Feet; ſuppoſe this to repreſent the Sun; then will a Globe $7\frac{2}{10}$ Inches repreſent Mercury; one of $17\frac{2}{10}$ Inches, Venus; one of 18 Inches the Earth; one of 5 Inches the Moon; one of 10 Inches Mars; one of $15\frac{1}{3}$ Feet Jupiter; and one of $11\frac{1}{2}$ Feet Saturn, with his Ring 4 Feet broad, and every where as far from his Body. In this Proportion, ſuppoſe the Sun to be at St. *Paul*'s, Mercury might be at the *Tower*, Venus at St. *James*'s Palace, the Earth at *Mary-le-bone*, Mars at *Kenſington*, Jupiter at

" *Hampton-Court*, and Saturn at *Cleifden*; all " moving round the Cupola of St. *Paul's* as " their common Centre. The Aphelion of " the firſt Comet would be about *Bury*, the ſe" cond at *Briſtol*, and the third at *Edinburgh*. But, " to take into our Idea one of the neareſt Stars, " inſtead of the Dome of St. *Paul's*, we muſt " ſuppoſe the Sun to be repreſented by the gilt " Ball on the Top of it; and then ſuch another " on the Top of St. *Peter's* at *Rome* will repre" ſent the Star."

THE Times in which the Planets move round the Sun in their Orbits are the Lengths of their Years; and the Times of their turning round their Axes are the Lengths of the Days and Nights taken together, in each Planet reſpectively.

HENCE, in Mercury, a Year is equal in Length to 87 Days 23 Hours with us; in Venus it is equal to 224 Days 17 Hours; on our Earth to 365 Days 5 Hours 49 Minutes; in Mars to one Year 322 Days 17 Hours; in Jupiter to 11 Years 313 Days 15 Hours; and in Saturn to 29 Years 167 Days 10 Hours.

IN Venus a Day and a Night is as long as 24$\frac{1}{3}$ Days and Nights with us; in Mars it is but 40 Minutes longer than ours; and in Jupiter it is only equal to 9 Hours 56 Minutes of our terreſtrial Time.

The Inhabitants about Venus's Equator are carried 43 Miles therewith every Hour by its turning round its Axis; thoſe about our Earth's Equator, 1042 Miles in the ſame time; thoſe about Mars 566; and thoſe about Jupiter's 25,940; beſides that of their hourly Velocities in their Orbits already mentioned.

The more that a Planet's Axis leans from a perpendicular to its Orbit, the greater is its Difference of Seaſons. The Earth's Axis leans 23½ Degrees; Venus's 75; thoſe of Mars and Jupiter very little; and thoſe of Mercury and Saturn are unknown, there being no viſible Spots on the Bodies of thoſe two Planets whereby to determine either their diurnal Motions, or the Inclinations of their Axes.

On our Earth, the Seas and unknown Parts contain 160,522,026 Square Miles; the habitable World 38,990,569; Europe 4,456,065; Aſia 10,768,823; Africa 9,654,807; America 14,110,874. In all, 199,512,595, which is the Number of ſquare Miles on the whole convex Area of our Globe.

The Moon ſhines only by the borrowed, or reflected Light of the Sun, as it falls upon that half of her which is at any time turned towards Him, (and it is ſo with all the Planets.) Hence, as the Moon goes round the Earth, her dark Side muſt be turned towards us at her Conjunction, or Change; and her enlightened Side towards us at her Oppoſition or Full. At the Quarters, half of of her dark, and half of her light Side is towards the Earth, and then ſhe appears juſt half Full, increaſing or decreaſing.

Twelve mean Lunations, or Courſes of the Moon round the Earth from Change to Change, contain 354 Days 8 Hours 48 Minutes 37 Seconds and 48 Thirds; conſequently, twelve Lunar Months want almoſt 11 Days of a Solar Year: And 19 Julian Years contain juſt 235 mean Lunations, and 1 Hour 27 Minutes 40 Seconds over: But 19 Tropical Years fall 2 Hours and 2 Minutes ſhort of 235 Lunations.

Sometimes, the Moon at her Change comes ſo directly betwixt the Sun and Earth, as to hide or eclipſe the Sun from our Eyes; and ſometimes ſhe is ſo directly oppoſite to the Sun when at her Full, as to go into the dark Shadow of the Earth, and be eclipſed her ſelf. Theſe Eclipſes would happen at every New and Full Moon, if the Moon's Orbit lay in the ſame Plane with the Earth's: But as one half of the Moon's Orbit is above, and the other half below the Earth's, croſſing it in two oppoſite Points called the Nodes, 'tis plain there can be no Eclipſes but when the New or Full Moon happens in or near about theſe Nodes. They move backward thro' all the Parts of the Earth's Orbit in 18 Years and 224 Days.

In 18 Years 11 Days 7 Hours and 43 Minutes, the Sun, Moon and Nodes always come together

together, or in a Line of Conjuction; Therefore, if to the mean time of any Eclipſe of the Sun or Moon in a Leap Year, you add 18 Years 11 Days 7 Hours and 43 Minutes, you will have the mean time of that Eclipſe returned again: But in reckoning from any Eclipſe in a common Year, you muſt add 18 Years 10 Days 7 Hours 43 Minutes to have the return of that Eclipſe.

THE Moon in a total Eclipſe would be quite inviſible, were it not for the Rays of the Sun's Light being ſo refracted by the Earth's Atmoſphere as to enter into its Shadow, and caſt that faint reddiſh Light upon the Moon which makes her viſible even in the greateſt Eclipſe ſhe can ſuffer.

An

An Aſtronomical Account of the Year of our SAVIOUR's CRUCIFICTION.

IN the fifth Lecture of my Courſes of Aſtronomy, I uſed to ſhew that there could not be a natural or regular Eclipſe of the Sun on the Day that our Saviour was crucified; which, by the Vulgar Account, was on the third of April in the 33d Year of his Age: On which Day, my Orrery ſhews that the Moon was Full, and conſequently could not then eclipſe the Sun. But, being ſometimes aſked how I could be certain as to the Year, my uſual Anſwer was, That ſuppoſing we be wrong as to the Year, yet we are told in Scripture that the Crucifixion was on the Day the Paſſover was eaten, and that the Paſſover was always kept on the fourteenth Day of the Month; which according to the Reckoning of the Jews, was the Day of Full Moon. St. *John ch.* 18. *v.* 28. *Exod. ch.* 12. *v.* 6.

THIS made me conſider if there might not be ſome Method found to aſcertain the true Year; and from the following Reflections an Argument ſoon occurred, which I hope will appear to deſerve ſome Regard.

THE Jews reckoned the Moon's Age from the firſt Day of her Appearance; and on account of the pureneſs of their Air they generally ſaw the Moon when ſhe was but one Day old: And ſo, by their Reckoning, the fourteenth Day of the Moon anſwers to our fifteenth, on which Day ſhe is at the Full. But if at any time they miſſed ſeeing her on the firſt or ſecond Day of her Age, they could eaſily judge by her Phaſes upon ſeeing her afterwards, how old ſhe was, and ſo reckon accordingly.

THEIR Cuſtom was to keep the Paſſover at the time of the Full Moon next after the Vernal Equinox; which, in Our Saviour's Time, fell upon the 22d Day of March.

BY comparing St. *Matthew ch.* 26. *v.* 20. with St. *John ch.* 18. *v.* 28. it would appear to us, that our Saviour eat his laſt Supper on the Day before the Paſſover was kept by the Jews: But by their Reckoning, it was all on the ſame Day; for they began their Day in the Evening, and eat the Paſſover any time betwixt the two Evenings.

THEY meaſured their Months by the Moon, and their Years by the Revolution of the Sun, which obliged them to intercalate eleven Days at the end of every Year; for twelve Lunar Months want almoſt eleven Days of twelve Months as meaſured by the Sun.

In the Year of the Crucifixion, the Paſſover Full Moon was on a Friday; for our Saviour was crucified on the Day next before the Jews Sabbath. Here we have the Day of the Week aſcertained.

As the Lunar Year falls eleven Days ſhort of the Solar, the Full Moon in any given Month muſt at the annual Return of that Month fall out eleven Days ſooner, and conſequently cannot fall again upon the ſame Day of the Week; for eleven Days meaſures a Week and four Days over. Hence, if the Full Moon, this Year, for Example, in April happens on a Sunday, in the next Year it will be on a Thurſday, unleſs the next be a Leap Year, in which Caſe there will be twelve Days Difference; and ſo, counting backward, make it on a Wedneſday.

Thus it is plain, that in different Years, the Paſſover Full Moons muſt fall upon different Days of the Week, unleſs when the Paſſover-Months themſelves differ; that is, when the Full Moon happens between the Vernal Equinox and the firſt Day of April, the Paſſover falls in March; but always in April when no Full Moon happens within this Limit.

Now, if it can be proved, that there was but one Paſſover Full Moon on a Friday in the Courſe of a few Years whereabout we imagine the Year of the Crucifixion to have been, (and it is generally allowed that our Account is not above

above four or five Years wrong) the Year in which it fell on a Friday muſt have been the Year ſought.

To determine this, I went to work with my Orrery, which in two or three Minutes may be rectified to ſhew the Days of the Months anſwering to all the New and full Moons and Eclipſes in any given Year within the Limits of 6000 Years, both before and after the Chriſtian Æra: And when once ſet right will ſerve for above 300 Years without any new Rectification. I began with the 21ſt Year after the common Date of our Saviour's Birth; and obſerving from thence in every Year to the 40th, was ſurpriſed to find that in the whole Courſe of twenty Years ſo run over, there was but one Paſſover Full Moon that fell on a Friday; and *that* One was in the 33d Year of our Saviour's Age; not including the Year of his Birth. But that it might not be ſaid, I truſted to the mechanical Performance of a Machine, I calculated the mean times of all the Paſſover Full Moons from Aſtronomical Tables for the above twenty Years, and found, as a thing very remarkable, that the only Paſſover full Moon which fell on a Friday in all that Time, was the one above mentioned.

I ſhall here ſubjoin a Table of the mean Times of all the Paſſover Full Moons from the aboveſaid Calculation, adapted to the Meridian of *Jeruſalem*; leaving it to the Examination of thoſe who are Judges of this ſort of Calculations.

FULL MOON. WEEK DAY.

A. D. 21---Apr. 15. --- 9 Aftern.--Tueſday.
22---Apr. 5. --- 6 Morn. --Sunday.
23---Mar. 25. --- 3 Aftern.--Thurſday.
24---Apr. 13. --- at Noon.--- Thurſday.
25---Apr. 1. --- 8 Aftern.--Sunday.
26---Apr. 20. --- 6 Aftern.--Saturday.
27---Apr. 10. --- 2 Morn. --Thurſday.
28---Mar. 30. -- 10 Morn. --Tueſday.
29---Apr. 17. --- 9 Morn. --Sunday.
30---Apr. 6. --- 7 Aftern.--Thurſday.
31---Mar. 27. --- 2 Morn. --Tueſday.
32---Apr. 15. --- 1 Morn. --Tueſday.
* ----- 33 --Apr. 3. -- 10 Morn. --Friday.
34---Apr. 22. --- 7 Morn. --Thurſday.
35---Apr. 11. --- 5 Aftern.--Monday.
36---Apr. 1. -- 2 Morn. --Sunday.
37---Apr. 18. -- 11 Aftern.--Thurſday.
38---Apr. 8. --- 9 Morn. -Tueſday.
39-- Mar. 28. --- 5 Aftern.--Saturday.
40---Apr. 16. --- 1 Aftern.--Saturday.

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